THE STORY *of* THE HUDSON

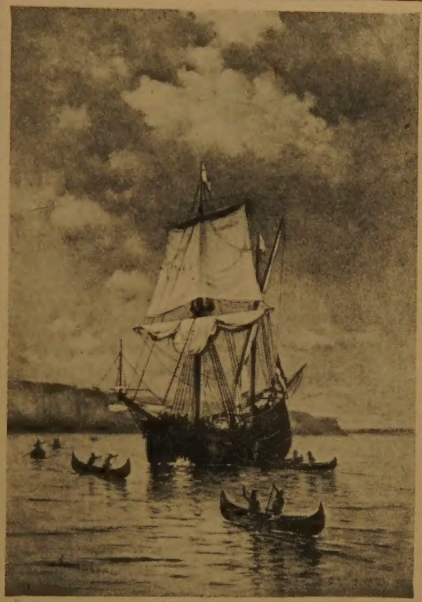
By ALBERT BUSHNELL HART
Professor of Government, Harvard University

MENTOR GRAVURES

MOUTH OF THE HUDSON, NEW YORK HARBOR

WASHINGTON IRVING'S HOME, "SUNNYSIDE"

PEEKSKILL BAY, SOUTHERN GATEWAY TO THE HIGHLANDS



DISCOVERY OF THE HUDSON
From painting by Warren Sheppard

MENTOR GRAVURES

THE PALISADES, SHOWING SUMMER CAMP SETTLEMENT

WEST POINT, VIEW FROM THE HUDSON RIVER

POUGHKEEPSIE, N. Y., AND BRIDGE OVER THE HUDSON RIVER

TIME was when the top notch of flattery for a Southern beauty was to name a Mississippi steamboat for her; and Captain Gray in 1792 turned the tables by calling the most majestic river in western North America, the Columbia, after his lady ship. A third pinnacle of fame is to name the river for the captain of the discovering vessel, and that was the happy fortune of Henry Hudson, a bold navigator and intrepid sailor; yet but for his river he would never have been classed among the immortals.

Indeed, that river is far greater than its godfather; for though outdone in length by hundreds of world streams, its topography and the liveliness of the people who dwell upon its banks have made it one of the most famous rivers. Its navigable length of 160 miles is an important link in a great commercial waterway, reaching to Chicago and Duluth and Fort William. It brings commerce to a place which disputes with London the distinction of being the most populous city on earth. Likewise, it suggests the historic legends and events of four centuries, and is intertwined with

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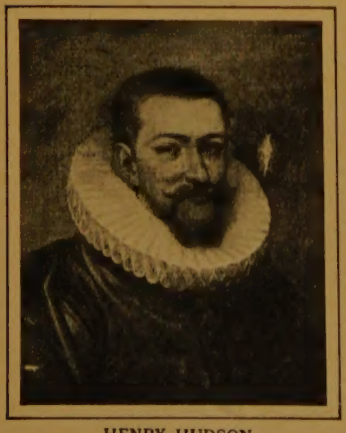
the romance of picturesque Indians and their unavailing attempts to push back the rising tide of European settlement.

LANDING OF HENRY HUDSON
The Indians believed Hudson and his men to be gods, and welcomed them with gifts

The Hudson is a special pet of the geologists, because in the lower two-thirds of its course tide-water twice a day flows from mouth toward source. In strict scientific sense, that Hudson which is navigated, visited and admired is an estuary, occupying the bottom trough of a stream which in bygone ages flowed in a valley which may be traced a hundred miles farther south under the present ocean waters. This long, straight, navigable Hudson is in fact a sea reach, a strait, from the northern end of which an easy land crossing reaches Lake Champlain. The actual course of running sweet water is shorter than that of the Merrimac or the Connecticut; yet it is Lord Hudson among American rivers, for its convenience, its navigability and its historic associations.

Various Names of the River

The Hudson River did not accept the name of an English sailor, sailing under the Dutch flag, without protests and rivalries. The Five Nations, who lived for ages on or near the head waters, could not name it for its discoverer, because to their minds it never was discovered: it was there when their ancestors appeared. The Senecas called it the "Skanehtade Gahunda," that is, "the river beyond the openings"; or (perhaps at a later hour of a festive day) the "Tioghsahronde Cahohatatea."* The "openings" were the valleys of the Hudson and its larger tributary, the Mohawk, where they came together.



HENRY HUDSON
From painting by Count Pulaski, in New York City Hall

The first European to describe the later Hudson was Verrazzano, in his voyage for the French king in 1524, whose first impression of the inhabitants is not unlike that of some modern visitors. He says, "After proceeding

*A puzzle for experts in pronunciation!

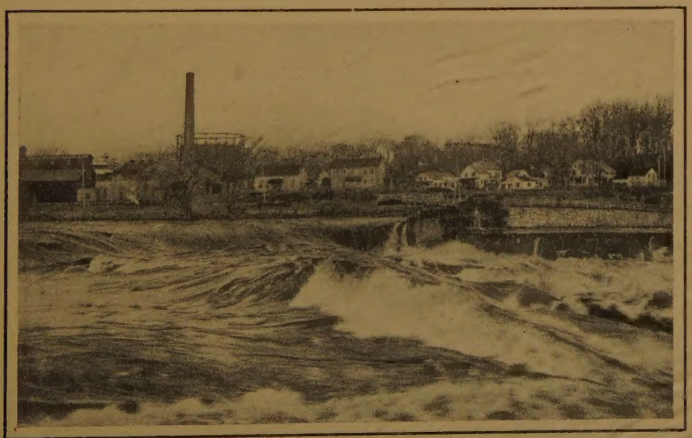
one hundred leagues, we found a very pleasant situation among some steep hills, through which a very large river, deep at its mouth, forced its way to the sea . . . we found the country on its banks well peopled, the inhabitants . . . being dressed out with the feathers of birds of various colors. They come towards us with evident delight, raising loud shouts of admiration, and showing us where we could most securely land. . . . We passed up this river about half a league, when we found it formed a most beautiful lake three leagues in circuit. . . . All of a sudden, as is wont to happen to navigators, a violent contrary wind blew in from the sea, and forced us to return to our ship, greatly regretting to leave this region which seemed so commodious and delightful, and which we supposed must contain great riches, as the hills showed many indications of minerals." The name that Verrazzano gave to this aboriginal Great White Way was Riviere Vendôme.

Courtesy, Hudson River Day Line

THE UPPER WATERS

The Sacandaga River, a rich tributary of the Hudson. The water which these Adirondack hunters are crossing, finally flows by the Statue of Liberty

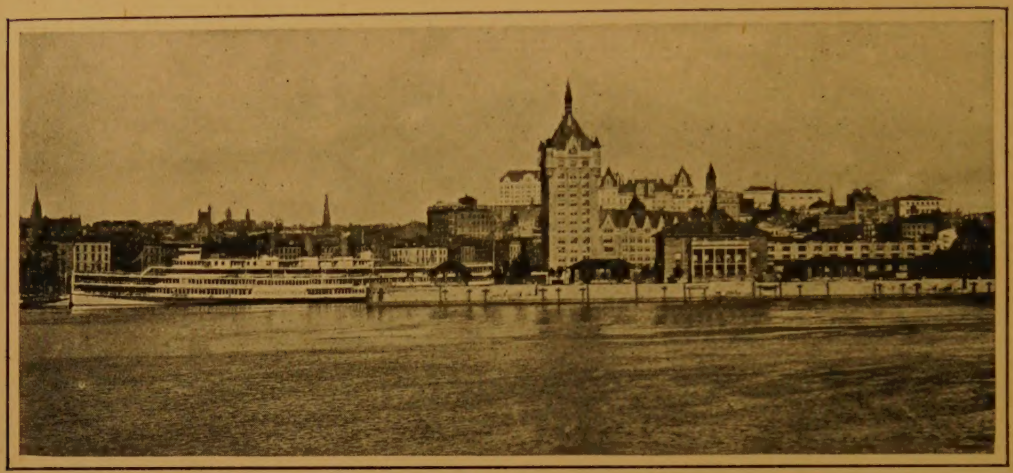
The year following, the Spanish navigator Gomez came along the coast, whence perhaps the name Rio San Antonio and Rio de Guamas, which appears on some maps. Hudson himself in 1609 appears to have used no name but the Great River. The Dutch tried to fix upon it the name of Prince Maurice or of River of the Mountain, sometimes the Nassau River. DeLaet in 1625 called it the Manhattas or Great North River of New Netherland, as opposed to the South River, which was the Delaware. The English early began to call it Hudson River; and when they seized the country in 1664 they had the opportunity to make that title of the river clear.



Courtesy, Hudson River Day Line

THE HUDSON AT GLENS FALLS—Scene of episode in *Last of the Mohicans*

Modern critics carp at Hudson, alleging that neither Hudson Strait, Hudson Bay, the Hudson's Bay Company, nor the Hudson River were first discoveries of his. Nevertheless, he deserves the



Courtesy, Hudson River Day Line ALBANY
View from the Hudson, showing the Day Line Boat *Washington Irving* at the dock

glory of the river, for he and his *Half Moon* were the first to explore its waters. If he stumbled on New York harbor in an effort to find a water route to the East Indies, what more did Columbus do?

Mate Juet wrote the record of the experiences of the fateful September 2, 1609, as follows: "We came to a great lake of water, as wee could judge it to bee, being drowned land, which made it to rise like islands, which was in length ten leagues . . . and from that lake or bay the land lyeth north by east, and wee had a great streame out of the bay." Thence the *Half Moon* made its way up the river, "passing by high mountains"; till, on the two and twentieth of September, "our boat returned in a showre of raine from sounding of the river; and found it to bee at an end for shipping to goe in. For they had beene up eight or nine leagues, and found but seven foot water, and unconstant soundings."

The Coming of Commerce

Thus began the international commerce from the mouth of the Hudson; for soon Dutchmen came, intent upon the fur trade, for which the river was a convenient funnel. The English misliked this Dutch colony; twenty-four years later the Dutch skipper De Vries found an English ship lying off Manhattan, the captain of which claimed that the land was English because "David Hudson first discovered this river and he was an Englishman." De Vries wanted to "help him away from the fort with *beans* from the eight-pounder"; and informed the new Governor, Wouter Van Twiller, "that I had no good opinion of that nation, for they were so proud a nature that they thought everything belonged to them."

Indians and Whites

In truth, the Hudson River, like the St. Lawrence, was an open highway up into the country of the Indians. Every mile of the Hudson and the Mohawk has an association with those original Americans. The Dutch

soon founded Fort Orange and a few towns farther west, at the gateway of the Five Nations, the redoubtable Iroquois, who later became Six Nations, the fiercest, best organized and toughest of the enemies of the early colonists. The Dutch burghers usually kept on the good side of these ferocities, and sometimes extracted a French missionary out of the fangs of their torturers. When the English came along, they too patted the backs of the Six Nations. Before the Revolution, Sir William Johnson of Johnson Hall made himself a sort of feudal magnate among the barbarians. They have left a few place names, such as Kiskatom and Niskayann in the midst of the Dutch towns of Esopus and Poughkeepsie and Saugerties and Schaghticoke. Long ago they and their kinsfolk faded away, though they still live in the pages of Cooper.

Courtesy, Hudson River Day Line

A HOME ON THE HUDSON

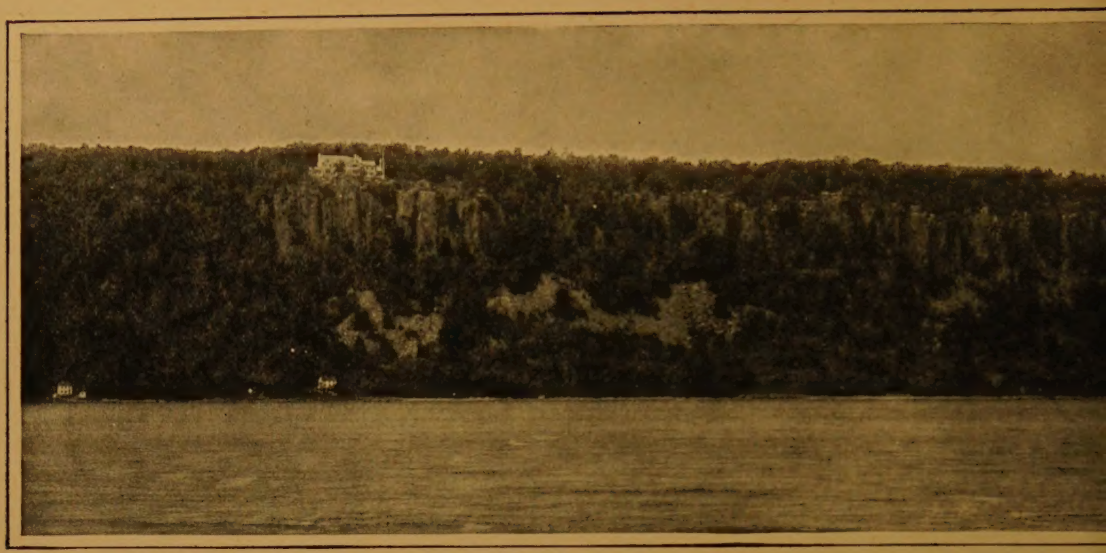
When this house was built by its owner, the late W. B. Densmore, at Staatsburgh, it was one of the largest private dwellings in the country

"The Last of the Mohicans" is staged for its most fascinating chapter at Glens Falls in the upper waters of the Hudson. All the world remembers how Cora and Alice and Uncas and Major Hayward and Chingachgook and Hawk Eye the scout fled to a spot where "the river was confined between high and cragged rocks. . . . These again were surmounted by tall trees, which appeared to totter on the brows of the precipice." The whole party took refuge in a "deep, narrow chasm in the rocks," where they fought their enemies; concealed themselves under a heap of brush, and were at last dragged out and made miserable captives by the Hurons.

Courtesy, Hudson River Day Line

CATSKILL MOUNTAINS FROM THE HUDSON

This range contains many peaks over 3,000 feet above the sea



THE LONG STRETCH OF THE PALISADES

The Upper Hudson

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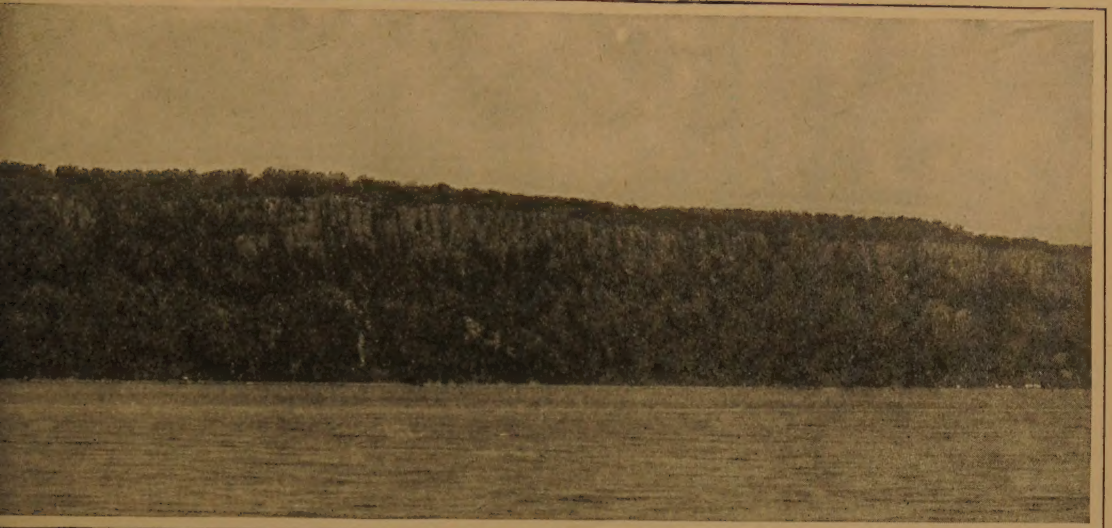
Glens Falls is a good point of departure for an historical pilgrimage down the great river. The stream heads fifty miles farther north on the south slope of the Adirondacks near Mt. Marcy and the Haystack. Historic interest begins at Fort Edward, whence the ancient carry of fifteen miles was the path of the marauding Indian, or the traveler, or the Colonial soldier, as the case might be, across to the head of Lake George. There, not more than five miles from the Hudson, was enacted the tragedy of the massacre of Fort William Henry in 1757, when the French were unable to prevent their savage allies from tomahawking, scalping and massacring hundreds of white men and women. Near by, Jane McRea was done to death by the Indians during the Revolution. Farther down the lake, near Ticonderoga, were fought various battles between the French and the English. Over the well-worn road from Lake Champlain to the Hudson passed the army of Burgoyne in 1777; and near the Hudson, at Bemis Heights, his army fought its last fight and was bagged by the Americans.

A few miles farther down, the Mohawk comes over the falls of Cohoes; it is hardly shorter than the upper Hudson, and far more important, because it leads up to the lowest divide between the ocean and Lake Erie, and is therefore the route of two railroads and the Erie Canal. According to the maps, the Great Lakes are drained through Lake Ontario by the St. Lawrence River, so that Milwaukee and Quebec are situated along the same stream. Commercially, the Great Lakes flow across Northern New York and down the Mohawk and the Hudson to the sea. This low depression, leading to one of the world's best natural seaports, has diverted both rail and water traffic from the Northwest to



VIEW FROM UPPER NEW YORK CITY

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New York City. The long and stirring annals of the Erie Canal are but one of many tributes to the world significance of the Hudson River.

Albany is a city set on a hill which cannot be hid; a French fort may have stood there once; the Dutch Fort Orange or Aurania, founded in 1624, was the central point in the upper valley. A village called Beverwyck arose between the fort and the river; and in 1664 James, Duke of York and Albany, generously divided his name so as to convert New Amsterdam into New York and Beverwyck into Albany.

In the neighborhood is the mansion of Rensselaerwyck. The founder, Killian Van Rensselaer, pearl and diamond merchant of Amsterdam, received a feudal grant of a trifling estate extending twenty-four miles down the river from Cohoes and twenty-four miles east and west from the river; much of which was divided into rented lease-holds. Two centuries later, when Stephen Van Rensselaer died in 1839, leaving four hundred thousand dollars in uncollected back rents, he prepared the way for the famous Anti-Rent War, which went on merrily in this neighborhood, and on the somewhat similar estates of the Livingstons and others.

From Albany Down

From Albany down the river, one hundred and sixty miles to New York, extends one of the beautiful rivers of the world. The slopes are not castle-studded like those of the Rhine, nor does the stream run in sweeps and curves like the upper Danube; but after flowing through a broad, shallow valley, flanked by rising hills, the Hudson enters a mountain region, culminating below Newburgh in the gorge of the Highlands. This course, easily followed by a rail line on either bank, or by steamer, cuts a

Photograph by Press Illustrating Service WEST POINT FROM OPPOSITE SIDE OF THE RIVER

cross section not only through the mountains, but through the history of three centuries. A few Dutch houses of the seventeenth century may still be noticed. Such comfortable mansions as those of the Van Cortlands and the Philipse family gleam from their surrounding shrubbery. The semi-English brick houses of a hundred years ago command the best river views. And the latest thing in revived Georgian architecture, with Greek porticos and Italian pergolas, occupies a point of vantage.

To the scenic beauty of the Hudson there is a cloud of witnesses. In 1744 Dr. Alexander Hamilton of Annapolis took passage by the Albany sloop and records that: "We weighed anchor and entered the Islands, which presented a wild, romantic scene of rocks and mountains." Isaac Weld in his quarto travels of 1799 says that "To describe all the grand and beautiful prospects presented to the view on passing along this noble river, would be an endless talk; all the various effects that can be supposed to arise from a happy combination of wood and water, of hill and dale, are here seen in the greatest perfection." George William Curtis, in his "Lotus Eaters," said "The Hudson has the most exquisite episodes. Its morn and evening reaches are like the lakes of dreams. Looking from this garden, at twilight, toward the huge hills, enameled with soft darkness, that guard the entrance of the Highlands, near West Point. . . . Out of that dim portal glide the white sails of sloops, like specters: they loiter languidly along the bases

Courtesy, Hudson River Day Line
A GLIMPSE OF THE RIVER AT WEST POINT

Photograph by Press Illustrating Service
LOOKING UP THE RIVER FROM OPPOSITE WEST POINT

of the hills, as the evening breeze runs after them, enamored, and they fly, taking my fascinated eyes captive, far and far away, until they glimmer like ghosts and strand my sight upon the distance."

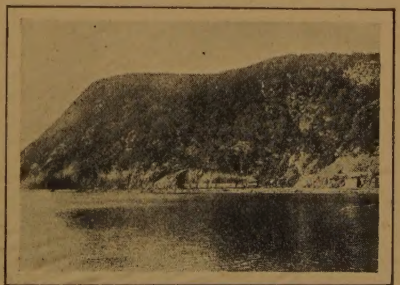
West Point

The most noted, as well as the most beautiful, spot on the Hudson is West Point, made a fortress during the Revolutionary War. Here Washington and Lafayette and a cohort of other military celebrities passed and stayed. Subsequently it became the site of the national Military School, the new buildings of which are majestic, vast, and lofty. The place will always go down to history chiefly as the scene of the Benedict Arnold treason. West Point, the Robinson house and the Joshua Smith house are all connected with this amazing episode.

In this dark tale of greed and treachery moves the spirited figure of André, the young and gallant, the imprudent, whose manly life was forfeited while the black-hearted Arnold escaped.

The First Steamboat

The whole length of the river is interspersed with memories of another exciting event—the trip of the first successful steamboat, the *Clermont*, August 11, 1807. Fulton's invention revolutionized river, lake and ocean travel; changed all the methods of intercontinental commerce, and sent the sailing ships of war to the scrap

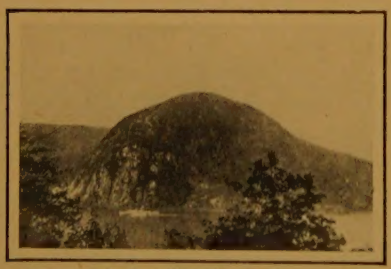


Courtesy, Hudson River Day Line
ANTHONY'S NOSE
Showing train leaving the tunnel

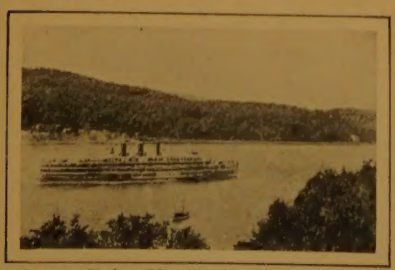
heap. His own account of this epoch-making success is as follows:

"I left New York on Monday at four o'clock and arrived at Clermont, the seat of Chancellor Livingston, at one o'clock on Tuesday; time, twenty-four hours; distance, one hundred and ten miles. On Wednesday I departed from the Chancellor's at nine o'clock in the morning and arrived at Albany at five in the afternoon; distance, forty miles; time, eight hours. The sum is one hundred and fifty miles in thirty-two hours, equal to near five miles an hour. On Thursday at nine o'clock in the morning I left Albany and arrived at the Chancellor's at six in the evening. I started from thence at seven and arrived at New York at four in the afternoon; time, thirty hours; space run, one hundred and fifty miles. Throughout my whole way, both going and returning, the wind was ahead; no advantage could be derived from my sails; the whole has, therefore, been performed by the power of the steam engine." A farmer who saw the steamer walking the water declared that he "had seen the devil going up the river in a sawmill."

Photograph by Press Illustrating Service
ROCKY POINT AND ROADWAY
On the Palisades opposite 180th St., New York



Photograph by Press Illustrating Service
STORM KING MOUNTAIN
The *Mary Powell* going down the river



Courtesy, Hudson River Day Line
NEAR POUGHKEEPSIE
Day boat *Washington Irving* going up the river

Fulton and Livingston built three other steamers, each an improvement on the previous one. The New York Legislature gave them a monopoly of steam travel on the Hudson within the State limits; but in the case of Gibbons *vs.* Ogden in 1824, the Supreme Court of the United States did away with this monopoly. Later appeared another river king, Cornelius Vanderbilt, who first and last owned about thirty river boats, and in 1847 backed his *Vanderbilt* for a seventy-mile race against the *Oregon*. Though the *Vanderbilt* bucked the other boat, the *Oregon* came in first, and the Commodore for once lost money.

The running time from New York to Albany was cut down in 1864 by the *Chauncey Vibbard* to six hours and forty-two minutes.

LOOKING UP THE RIVER FROM GRANT'S TOMB

Below the Highlands

Below the Highlands the river widens out into a majestic tideway, flanked on the west by the picturesque Palisades, large parts of which have recently been made a public park. On the other side lie beautiful slopes which include Sleepy Hollow and all the Washington Irving country. Then the descending steamer approaches the heights of Fort Washington, where the little American army escaped across to New Jersey in 1776. The Great River here takes on the ancient name of North River, and its shores are lined with wharves which envelop great steamers. The myriad towers of Greater New York shoot up into the air, marking the splendid city which owes its site and its amazing growth to the confluence of the Hudson, the East River and the Narrows.

ROBERT FULTON'S BOAT *CLERMONT*

The model of the first steamboat passing up the river in the Hudson-Fulton Celebration, September, 1909

SUPPLEMENTARY READING

THE HUDSON RIVER FROM OCEAN TO SOURCE *By E. M. Bacon*

CHRONICLES OF TARRYTOWN AND SLEEPY HOLLOW *By E. M. Bacon*

OLD STEAMBOAT DAYS ON THE HUDSON RIVER *By D. L. Buckman*

THE PICTURESQUE HUDSON *By C. Johnson*

***Information concerning the above books may be had on application to the Editor of The Mentor.

A LETTER FROM FRANCE

One of the best and brightest young men on The Mentor staff joined the Ambulance Corps several weeks ago, and is now on his way to the front "somewhere in France." The following letter, just received, is so good that you must all read it.

★ ★ ★

SANDRICOURT, OISE.

"My time since I reached France has been spent mostly in Paris—three weeks of it. We had no duties whatever for the Corps, so had a great chance to see every bit of 'Paris, the Incomparable,' as Mr. Moffat named it. Hewas quite right—I've never seen anything to come up to Paris —nor any of France. The Corps put us up at hotels in town, and paid our necessary expenses, so the hole in my fortune is not so large as 'three weeks in Paris' would indicate.

"The lazy life in Paris got a little tiresome, so we were all glad to get orders to entrain for this place. We came on Friday. This is Monday, and in that short time we have all fallen in love with the spot.

"It is a 10,000-acre estate owned by Mr. Goelet of New York, and our quarters are in what once was, I imagine, the grooms' and stablemen's house. It is a huge quadrangle—the court being at least 150 feet square. Three sides are stables —the fourth the chambers, kitchen, etc. Built on a hillside (France seems to be all gentle hillsides with pleasing views) with the house on the upper side, we have a splendid outlook on the surrounding fields and woods and pastures—all simply beautiful. America has the same things, but never are they so thoughtfully planned nor cared for from the beauty standpoint. Even in the most remote quarters—here, for instance—where strangers come but rarely, not the slightest detail of appearance has been neglected. This must be part of what is meant by 'old world' finish and refinement. It is easy to see that it takes centuries to attain.

★ ★ ★

"So here we are—sixty of us—in the midst of the most beautiful country, secluded and quite happy. We came to be trained for our work at the front, and this training was today started. It will last until our ambulances are ready for us, at which time we will go to the front—but just when this will be, no one can say. I hope it will be soon, for surely a wonderful experience is waiting there for us all.

"It is very interesting right here, though. I only wish I could tell you all about what we've seen here of the war that *was*, and what we hear of that which *is*. But we've been forbidden to write out the first word about it. So I'll have to tell you when I get back.

"Our duties are quite light—a few fatigues of one kind or another, shared by all of us, leave a good part of the day for walking, or baseball, or just resting under the trees and dozing. Our drills are short, and ambulance instruction interesting. The food is splendid for an army camp, the officers mighty good, the quarters pleasant, so we are all mighty happy. You can imagine sixty fellows such as these —you saw them at the pier—all together, and what fun there is. The boys are absolutely the best! Not a lot of adventure-seeking chaps, but serious, active, willing young fellows with 'American' written all over them. With every day that goes by I am more glad that I have come—it is all so very new and different.

★ ★ ★

"Since arriving it has grown on me more and more that there is only one thing America can do—will do, and that is to send an army here at once, and follow it up with more as rapidly as possible. Now we are in, we must stand firm and 'see it through,' no matter what it involves.

"I am sitting out in the orchard, with my back against an apple tree, and the birds all about are singing their heads off. A lovely day, a breeze that actually whispers, a peaceful orchard, and a smell of good fields in the air, the voices of a few chaps chatting a short way off, perfect calm and quiet everywhere, complete and happy content—these things would make it hard to believe that here is a land in the struggle of a terrible war, if it were not for the occasional distant booming of cannon.

★ ★ ★

"Please send me *The Mentor*, *The American*, and *Every Week*. Reading matter will be mighty highly prized, not only by myself, but by every fellow in the outfit, for all such things are passed around and swapped. You know what *The Mentor* meant to Sergeant Bell, that Scotch officer who wrote to us from the trenches last year.

"Au revoir.

RALPH."

PREHISTORIC ANIMAL LIFE

The Siberian Mammoth, or Hairy Elephant

ONE

IN going over the records of ancient history, we find many notes telling of the discovery of bones of giants, found buried in the earth and identified by learned writers of the time as the remains of various traditional heroes. The ancients believed firmly that these bones were the remains of giant men. We know today, however, that these reports were probably based upon bones or skeletons of the mammoth or other species of extinct animals; for aside from their massive proportions, the bones of the mammoth resemble human bones more than one would expect, and if found scattered and broken might well be taken for bones of "giants" by people to whom elephants were not well known.

Elephants now inhabit only the tropical regions of the Old World. This extinct species (the mammoth) lived in all the northern countries in prehistoric times, ranging as far north as the borders of the Arctic Ocean, where its remains have been found near Point Barrow in Alaska and in the Liakhof Islands off the coast of Siberia. Entire carcasses have been found, buried in the frozen tundra soil in northern Siberia, and similar remains in northern Alaska, while skulls and skeletons are found buried in peat bogs and river deposits in the United States as far south as the Carolinas, and through most of Europe and northern Asia. The frozen carcasses, preserving hide and hair, show that, unlike the living elephants, this species was covered by a heavy coat of coarse black hair, with a reddish brown underwool. It was well fitted, therefore, to withstand the cold of the Arctic regions, and during the Glacial Epoch it lived all along the southern margin of the great ice sheets that then extended as far south as New York and Pennsylvania, and covered all of northern Europe. The contents of the stomach show that it fed upon leaves and twigs of deciduous trees—trees that shed their leaves in the fall, such as birches and poplars and other northern species—so that there is no doubt of its living in a cold climate.

In Europe, probably also in North America, the mammoth was a contemporary of primitive man. Among the prehistoric drawings preserved upon the walls of caves in central Europe and engraved upon ivory and bone, are several that clearly represent the mammoth. They show the animal with heavy coat of rough hair and a thick boss of wool or matted hair on top of the head, as in the modern bison. The fidelity and artistic quality of these ancient drawings of an animal extinct before the dawn of recorded history is attested by the actual remains discovered in our times. No trustworthy trace remains in history or tradition of the existence of the mammoth. It perished probably many thousand years ago. But it is, and has been for more than a century, familiar to everyone—so much so that its name, which is the Russian or Siberian appellation, said to be derived from the scriptural "behemoth," has come into common use to express gigantic size.

PREPARED BY THE EDITORIAL STAFF OF THE MENTOR ASSOCIATION
ILLUSTRATION FOR THE MENTOR, VOL. 5, No. 13, SERIAL No. 137
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PREHISTORIC ANIMAL LIFE

Smilodon, the Saber Tooth Tiger

TWO

THE saber tooth tigers belonged to the cat family, like the existing lions and tigers. The largest of them were of the size of a grizzly bear, larger than any living lions, and very powerful. They differed from any of the true cat family in the method of attacking their prey. A modern lion or tiger seizes its prey by biting, closing its short, heavy jaws upon it and holding with the strong sharp fangs. Consequently, we find that the muscles for closing the jaws are very powerful, and the upper and lower fangs, or canine teeth, are of equal size. But in the saber-tooths the lower canines are small and weak, and the upper pair are lengthened out into great flattened curving dagger-like blades, projecting sometimes seven inches from the sockets. Moreover, the muscles for closing the jaw are quite weak, while it is so shaped that it can be opened to an extraordinarily wide gape. Further, the muscles that pull the head downward and forward upon the backbone, slender and weak in the true cats as in most other animals, were in the saber-tooths exceedingly large and powerful, enabling the animal to strike a terrific downward blow with his great tusks.

It seems, therefore, that the saber-tooth, instead of seizing his prey and dragging it off, must have sprung upon it and stabbed repeatedly with the tusks until a vital spot was reached or the prey fell from loss of blood. Evidently this method of attack would enable the saber-tooth to prey upon large, thick-skinned animals which are not usually attacked by lions or tigers, while he was not so well suited to catch the smaller and more active creatures. The animal was more massively proportioned than the lion or tiger, with short, powerful limbs and short tail like a bear. The fore legs are especially stout, with very large claws. Probably, therefore, the *Smilodon* preyed upon the mammoths and mastodons, the great ground-sloths and other giant herbivora of his time. With such habits we may consider him as of bold and fearless temper, a fierce and terrible enemy to the larger animals, yet with a contemptuous tolerance of the smaller creatures, whom he neither harmed nor feared. In fact, the great saber-tooth may have realized the characters attributed to the lion of heraldry and legend, which the real lion certainly does not, in spite of his noble appearance. It is the saber-tooth rather than the lion that should really be the favorite national emblem, and would have been, doubtless, had he survived in Europe to medieval times.

In the Old World, however, as well as in the New, the whole race of saber tooth tigers seems to have become extinct before the dawn of history. They were contemporary with primitive man in prehistoric times, and possibly the nobility and magnanimous character attributed to the lion by tradition may be in part a reminiscence of the saber-tooth, handed down from the experiences of our prehistoric ancestors.

Fossil remains of the great saber-tooth tigers are ordinarily rather scarce. They do not seem to have been especially common animals, although their range was almost worldwide, in all the great continents except Australia. The asphalt deposits at Rancho La Brea, near Los Angeles, California, however, have yielded over a thousand skulls, and a proportionate number of skeleton bones of these animals. The skulls and bones of many other animals, especially bison, ground-sloths, extinct horses, camels, mastodons and mammoths, bears, gigantic extinct lions, and smaller animals, and numerous kinds of birds, have been obtained in this remarkable deposit. This is explained by the manner in which this asphalt deposit was formed. It accumulated around the margins of a series of petroleum springs. As the petroleum came to the surface and evaporated it left a sticky residue of semi-liquid asphalt, gradually hardening where it overflowed, but kept soft near the edges of the springs by the oil continually welling up from below. A film of dust covered the asphalt, and water accumulated in the hollows after rains. Animals that came to drink and attempted to cross were caught in the tenacious asphalt as in a quicksand, and sank slowly down into the depths of the springs. These animals, when caught, served as a lure to attract the beasts and birds of prey, which fed upon them, and they in their turn, coming near to devour the unfortunate victims, were caught by the treacherous asphalt, and served as decoys to attract still more.

The South American saber-tooth is a little larger than the California species, and is best known from the skeleton in the American Museum of Natural History, New York City.

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THREE

AMONG the many modern animals whose ancestry can be traced through successive stages of the Cenozoic era, the horse affords the best illustration of evolution. The modern horse is familiar to everyone; it is highly specialized and peculiar, both as to teeth and feet; the ancestral series is exceptionally complete, connecting it with the primitive mammals of the beginning of the Cenozoic; and the cause of the changes can readily be seen as an adaptation to its particular food and habitat.

At the beginning of the Cenozoic era we find a very primitive group of hoofed animals, the Condylarthra. These represent in a general way the ancestors of the horse and of the tapir, rhinoceros, and so on as well. They have five toes on each foot, each toe tipped with a small, rather narrow hoof. The molar teeth are somewhat like our own, low-crowned, with the crown made up of a few rounded hillocks or "cusps," separated by furrows or "valleys." All the premolar teeth (before the molars and behind the canines or front teeth) are of a simple cutting type, save the last next to the molars, which is partly of crushing type.

Such were the ancestors of our modern hoofed quadrupeds. Of their descendants each race has followed its particular road of evolution and specialization, fitting it to its food and habitat. The horse family, adapted to live on the open grassy plains, has evolved its limbs and feet into a perfect mechanism for speed and endurance in open and more or less level country. In the course of that evolution the side toes have gradually dropped out of use and disappeared, until the central toe (the hoof) alone is left; the compact, perfected mechanism of the joints will reward a careful study. Feeding upon the hard, dry grasses of the plains, the horse has evolved in its cheek teeth a very effective grinding apparatus.

The earliest direct ancestor of the horse family as yet recognized is the *Eohippus* or four-toed horse of the Lower Eocene period. In this little animal, about as large as a terrier dog, there are four complete toes on the fore foot and three on the hind foot. The inner toe of the fore foot is wholly lost, but small vestiges still remain of the missing inner and outer toes of the hind foot, in the form of little pointed rudiments or splints of bone at the back of the foot, just below the ankle bones. The molar teeth are short-crowned, but the rounded cusps have been converted into imperfect cross crests and outer crescents. The premolars are still simple.

Then through successive stages of evolution the ancestral horse, designated by science as the *Orohippus*, then *Mesohippus*, and other names indicative of progress, developed gradually the physical characteristics of the horse of today. The teeth changed to grinders, and in the feet the side toes degenerated until only the middle toe is left.

A steady increase in size accompanied these changes in construction, and in every part of skull and skeleton there were correspondingly gradual and continuous alterations, less obvious and extensive than those in the cheek teeth and feet, but all tending to the same purpose of perfecting the mechanism.

The evolution of the horse was a gradual change. The changes affect not one or a few parts of the skeleton, but every portion is modified in the same gradual manner; and the more carefully the mechanics of the skeleton are studied the more clearly does it appear that every modification is an adaptation to the requirements of its mode of life. It is equally obvious that the evolution of habit and of structure must have gone hand-in-hand. *Eohippus* could not have had the habits of the modern horse; it would have been a physical impossibility. But his differences in structure from his contemporaries, tending in the direction of the horse, imply a similar trend in habits. The precise method by which these small modifications of habit and structure were transmitted, preserved, and accumulated, is a problem of modern biology, and much light has been thrown upon it by recent researches into the laws and processes of heredity. The fossil record shows us simply the fact of gradual evolution, and in obvious adaptation to a gradually changing environment.

The modern horse is today man's most useful and, with the exception of the dog, his most faithful servant and companion. It is interesting to note that of all the members of the horse family—such as the zebra, the quagga, and others—only two have shown any aptitude for domestication. These are the horse and the ass, whose patience has become proverbial. It is not known for certain even now whether these two species have a different mental constitution from the others, causing a natural capacity for entering into relations with man, or whether it may be due to their having been brought gradually into this relation by long continued efforts on the part of man himself. From time to time attempts have been made to add new species to the list of our domestic animals, but, with the exception of the sturdy and serviceable mule—which is a hybrid—these have in almost every case ended in failure.

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THE Amphibious Dinosaurs were the largest of all four-legged beasts that ever lived. The *Brontosaurus* is estimated to have attained a weight in life of thirty-five to forty tons, and some of his less known relatives surpassed even this ponderous giant. The thighbone of the mounted skeleton in the American Museum of Natural History weighs in its petrified condition 570 pounds; the length of the skeleton is 66 feet 8 inches, and its height at the middle of the back is 15 feet. Among living animals only the larger whales exceed this size, and no land quadruped approaches it.

It was a giant reptile, but unlike modern reptiles it had long, straight, massive limbs like the elephant, and a long neck and small head, with a row of small blunted teeth in the jaws. The skin was thick and leathery, and the claws blunt, like those of a tortoise.

The *Brontosaurus* lived at the end of the Jurassic period, about the middle of the Age of Reptiles, and its remains are found in fresh-water deposits accumulated near the mouths of great rivers of that era. The skeleton on which the restoration pictured on the other side is based was found in Wyoming, a few miles north of Medicine Bow; others have been found in Utah and elsewhere in the United States; and near relatives have been found in other parts of the world, always buried in the delta formations of ancient rivers and low-lying swampy coasts.

It is probable that these animals lived in the river channels and bayous, wading in water of moderate depth and feeding upon the soft, succulent vegetation which grew around them. They seem to have had no means of protecting themselves against their enemies, the great carnivorous dinosaurs of the land, save by retiring into deeper water beyond their reach. The blunted teeth and claws would be of little use as weapons, and they had no bony armor to protect them. The brain is very small and of low type, and the animal seems to have been slow, unintelligent, and largely automatic in its movements.

For such life habits as these the skeletons of Amphibious Dinosaurs are remarkably well adapted. The massive and ponderous leg and foot bones would serve to weigh down the limbs and aid in preserving a footing in the water. The backbone and neck and head, on the other hand, are composed of an elaborate system of thin plates and braces, reducing the weight of the bone to the utmost minimum consistent with preserving the broad surfaces necessary for joints and muscular attachments—these for mechanical reasons could not be reduced. Thus the part of the animal which was more or less out of water was reduced to a minimum of weight. The nostrils, drawn back to the top of the head, would enable him to lie submerged all but the tip of his nose; and the long neck and legs allowed him to wade in water up to thirty-five or even forty feet, or in shallow water to reach up to the tops of considerable trees and strip off their soft, fresh foliage, to feed upon the young shoots.

The whole tribe of Amphibious Dinosaurs became extinct in the Lower Cretaceous Period, long before the close of the Age of Reptiles. No race of quadrupeds has since adopted similar habits, and none has attained such gigantic size. We cannot readily compare them with any modern type of animals, and can only infer from their skeleton structure the habits of life to which they may have been adapted. We may indeed be far astray in our theory. If the whale were an extinct race, no one would guess rightly as to its food habits from the study of a skeleton.

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SIXTY-THREE years ago an expedition under the American geologist, Ferdinand V. Hayden, traversed the western plains of the United States, then unsettled and infested by more or less hostile Indian tribes, as far as the Upper Missouri. From the bad lands of the Judith River they secured a number of fossil teeth, the first remains of dinosaurs to be found in this country, and among them were teeth of a strange new reptile which Doctor Joseph Leidy of Philadelphia described under the name of *Trachodon*. Subsequently, a considerable part of the skeleton of a gigantic fossil reptile was found in the green sands of New Jersey, extensively quarried in those days for phosphate fertilizer. Leidy described this by the name of *Hadrosaurus*, and it was mounted in the old Academy of Sciences Museum in Philadelphia. Later discoveries in the West showed that the *Trachodon* and *Hadrosaurus* were the same animal, and that it had the remarkable skull with broad, flattened horny bill like a gigantic duck's head, shown in the restoration pictured on the other side.

Many complete skeletons have since been discovered, and are mounted in various museums, and some had more or less of the skin impressions preserved in the rock. One has the skin so complete, lying in wrinkled folds shrunken close over the surface of the skeleton, that it has been called the "Dinosaur Mummy." The "mummy," together with two complete mounted skeletons of the *Trachodon*, and fossil skeletons of a number of its relatives, found in the Western States and Canada, may be seen in the American Museum of Natural History.

In addition to his duck-like bill, used in cropping vegetation, this dinosaur had a very effective grinding apparatus for chewing, in the numerous rows of small teeth packed close together in each jaw. There are over two thousand teeth in the jaws, new rows coming up into use as the old ones are worn down to the roots. This great battery of teeth served the same purpose as the grinders of a horse or a cow.

The animal was as large as a small elephant, and for all his kangaroo proportions he was too big and clumsy to leap like a kangaroo, but stalked along on the hind legs or sometimes on all fours, the long, heavy tail trailing behind or used to balance the body weight. The skin was quite thin, and probably had a spotted color pattern, made up of numerous tiny plates arranged in groups, but not of overlapping scales. He seems to have been entirely defenseless; but with the great flattened tail and webbed feet was clearly an excellent swimmer. We may suppose that he took refuge from the gigantic and savage carnivorous dinosaurs that lived in the same region, by retiring into deep water beyond their reach.

Sometimes the remains of duck-billed dinosaurs are found in marine formations deposited some distance out at sea; but for the most part they lived in the great delta swamps that then extended from the Gulf of Mexico northward to the Arctic Ocean. Fossil figs, bananas, sycamores and tulip trees show that the climate was then warm and moist, much like it is today along the Gulf coast.

The gradual rise of the land and drying out of the swamps put an end to the reign of the dinosaurs, and during the three million years or so that have since elapsed, the ancestors of our modern quadrupeds slowly evolved into their present size and characters. It was only near the end of this long subsequent era that man appeared upon the earth.

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MANY people wonder why the huge animals of prehistoric times did not survive, and why they are not to be found in the modern world. The *Uintathere* explains this very plainly. This extinct giant had a brain that was curiously small and of low type, indicating an intelligence a little above the grade of snakes and far below the rhinoceros or hippopotamus. In this and in his inefficient grinders (teeth) may lie the reasons for his early extinction. It may also account for his limited range on earth, since remains of this animal have been found chiefly in the State of Wyoming, although it is probable that he ranged over a considerable region in North America.

The *Uintathere* lived in the early part of the Age of Mammals. It was as large as a small elephant, and probably looked a good deal like an elephant in body and legs; but the head is altogether different. There was no trunk, and the head carried two or sometimes three pairs of "horns," stout, bony bosses like the horns of a giraffe. The upper canine teeth project downward as large compressed saber-like tusks, dangerous weapons no doubt in fighting, but chiefly used for the more peaceful purpose of stripping the leaves and twigs from branches of trees, if one may judge from the way in which they are usually worn. The lower front teeth also assisted in browsing after this fashion, while a set of cheek teeth, curiously small for so large an animal, helped to chop up and macerate the food.

The small size and low type of brain is a striking feature of the *Uintathere*. In intelligence he must have been lower than almost any modern mammal, although higher than a reptile. It is evident that the development of huge size, of tusks and horns and so on, was not accompanied with any increase in intelligence.

The skulls and fossil skeletons of these animals have been found chiefly in southwestern Wyoming, in the Bridger and Washakie basins. These regions are now broad stretches of arid sage-brush plains, cut up into bad lands along the valleys of the streams that come down from the neighboring mountains. Some parts of the Bridger basin are irrigated by the water from these streams, but elsewhere the country is dry and almost desert. At the time when these *Uintatheres* lived the conditions were very different. The region was probably heavily forested, with a warm, moist climate, as now prevails in the Southern States. Certainly it was low-lying, flat and subject to floods which from time to time converted large areas into shallow lakes. Two of the skeletons which have been found had clearly been mired in the soft marshy bottom lands, and others may have been entrapped in the same manner in the muddy stream beds loaded with volcanic ashes, washed down from the hills all around. In the bad land sections vast areas of bare rocks are exposed, cut up into a complex labyrinth of dry gullies and canyons. Such places are the hunting ground of the "bone-digger." Where the rocks are covered with soil or with vegetation it would be a hopeless task to dig down on the chance of finding fossil bones. He has no divining rod or other magic means of telling where they are hidden beneath the surface; their discovery is simply a matter of diligent hunting and of recognizing a prospect when seen. In the bad lands he can search persistently the endless maze of bare rocky ledges and slopes until he finds scattered fragments of weathered bone, showing where some fossil specimen, perhaps a skull or skeleton, is exposed and partially destroyed by rain and wind and frost along with the rock in which it was buried. Here he stops and investigates with pick and chisel, to find out whether enough of the specimen remains in the rock to be of any value. If he is fortunate, and its destruction by weathering has only begun, he may secure a skull or skeleton practically complete; this is one of the rare finds that mark a red-letter day. The process of collecting and transporting the fossil to the museum, of extracting it from the rock in which it lies, articulating and mounting the skeleton, is a long and difficult operation, involving months, or even years, of expert labor, before it is completed and set up in a museum.

Meanwhile, the skeleton is studied and compared with those of other animals, living and extinct, to gain a concept of its relationships and probable appearance and habits, and of the environment in which it lived. The associated animals and plants, the character and origin of the geological formation, also afford evidence for this reconstruction, which is finally depicted by the skilled brush of the artist. Many points must remain uncertain—the color and markings, the hair, the form of the ears; but in most respects the restoration here shown is no fanciful invention, but rests upon an assured basis of fact.

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